



Soil Transformation of European Catchments (SoilTrEC) Project Fact Sheet (www.soiltec.ec)

Soil – the Heart of Earth’s Critical Zone

Soil in Earth’s Critical Zone

Earth’s Critical Zone is the thin surface layer of our planet that extends from the top of the vegetation to the bottom of drinking water aquifers. Soil is at the heart of the Critical Zone and delivers many soil functions that provide important environmental goods and services that are essential for humanity. We cannot survive without soil.



Photo is courtesy of UK Natural Environment Research Council Centre for Ecology and Hydrology, Bangor, Wales

Earth’s Critical Zone is the thin surface layer that provides most of our life-sustaining resources.

Essential soil functions within the Critical Zone include:

- Biomass production
- Storage and transmission of water
- Storage of carbon and reduced greenhouse gas (GHG) emissions
- Nutrient transformations
- Pollutant transformations
- Providing biological habitat
- Maintaining Earth’s gene pool

Soil forms when rock breaks up and dissolves at Earth’s surface, from the action of water with the help of plants and soil organisms. The mineral particles that form, bind together with living organisms and decaying organic matter to create larger aggregates of soil material. Fertile soil is rich in aggregates. As a rough guide, fertile soil has more than 60% of its weight contained in the form of aggregates that are greater than 0.25 mm in size.

Human Impact on Soil and the Critical Zone

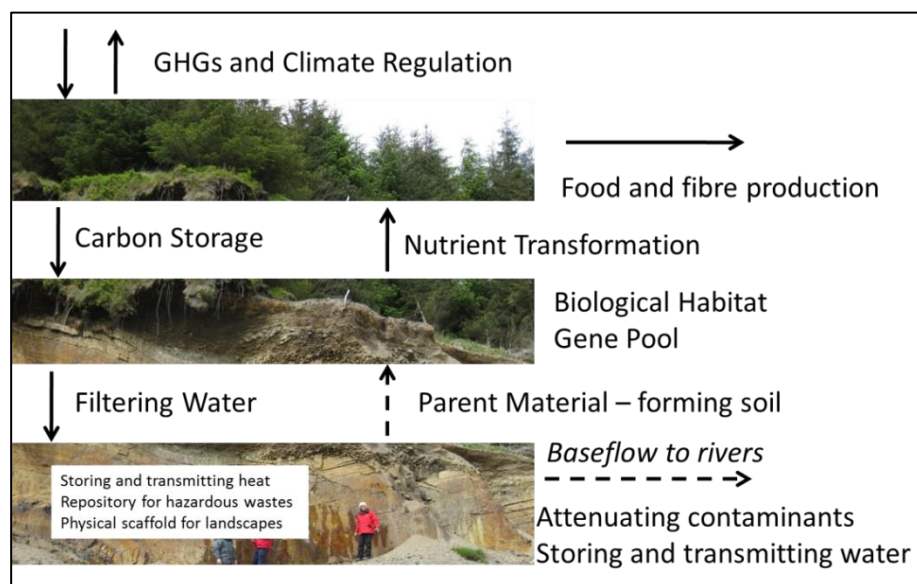
The Critical Zone and soils are under huge pressure from growth in human population and wealth. By 2050 it is projected that Earth’s population will exceed 9.5 billion people with a predicted quadrupling in the global economy, doubling in demand for food, doubling in demand for energy and biofuel crops and more than 50% increase in demand for clean water

These pressures have already led to extensive soil degradation worldwide.

- Since the 19th century, around 60% of soil carbon in organic matter has been lost.
- In the past 25 years one-quarter of global land area shows declining soil functions.
- Soil erosion from conventional agriculture is up to 100 times faster than soil formation.
- Draining peatlands worldwide causes peat loss 20 times faster than the peat formation.

Soil Threats

Increasing resource demands are causing soil degradation worldwide. Soil functions are lost due to erosion when bare soil is swept from the land surface by wind and water; desertification that occurs when loss of soil organic matter is so severe that soils no longer retain nutrients and support vegetation; degradation from pollution and from salts that are left behind when irrigation water evaporates; compaction from machinery and tillage that destroys larger soil aggregates; and sealing over by expansion of cities, buildings and roads.



Flows and transformations of material, energy and genetic biodiversity contribute to soil functions. The flows connect the different parts of the Critical Zone (left) and transmit the impacts of human activity through the Critical Zone. Good soil management reduces bad impacts.

The Critical Zone Chain of Impact

Our results show that the Critical Zone flows are linked closely together through soil and transmit human impacts from the land surface throughout the Critical Zone. Our research uses field observations and computer calculations and to simulate how these flows are affected by soil threats. Computer simulations guide where and how people can intervene in soil management – to protect soil functions and life-sustaining Critical Zone resources.

For more information visit SoilTrEC website: www.soiltrec.eu

Contact us: Prof. Steven Banwart, SoilTrEC Project Coordinator, University of Sheffield.

Email: s.a.banwart@sheffield.ac.uk